

SIMULATION AND STUDY OF NATURAL FIRE IN A WIDE-FRAMED MULTI-PURPOSE HALL WITH STEEL ROOF TRUSS

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Future view of the Helsinki Fair Centre.

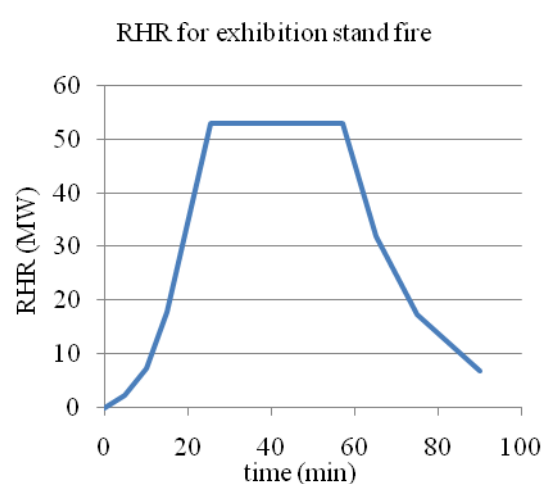
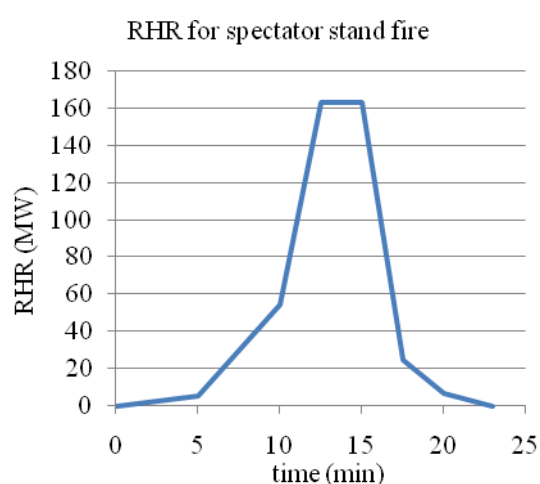
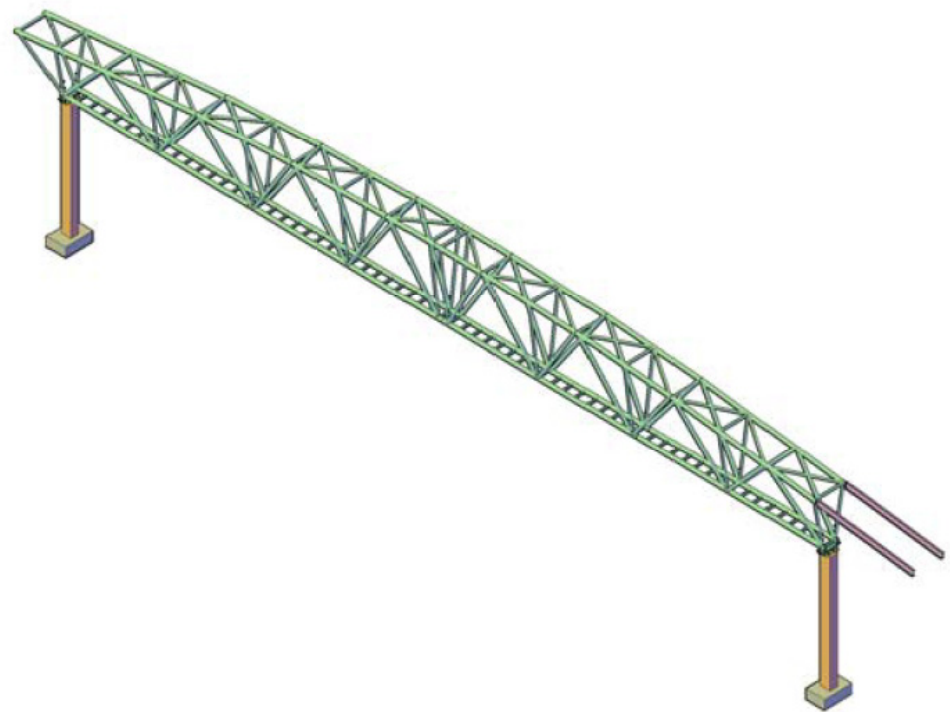
Forming a major part of an extensive long-term development plan of the Helsinki Fair Centre, a new 14500 m² multipurpose hall, designed in co-operation between Finnish and German architects, will be built in Helsinki, Finland.

The natural fire safety concept was used to do a performance-based structural fire safety design of the steel roof trusses in this hall. This made it possible to estimate whether the roof trusses can be safe in the case of fire without passive fire protection or not.

Two prescribed design fires were used in the study; a spectator stand fire and an exhibition stand fire. They were chosen based on the possible severity of their effect on the steel roof trusses.

PyroSim was used to build the fire simulation models for FDS v. 5.2. The models were equipped with an automatic sprinkler system and a smoke exhaust system. In the first set of simulations the sprinklers' suppressing effect on the design fires was not taken into account. In a second simulation of the spectator stand fire the effect was taken into account according to a method reducing the maximum rate of heat release.

The measured temperature inside the hall remained quite low in general. The temperature of the steel roof truss was calculated from the measured adiabatic surface temperature according to Eurocode 1 and 3.



A FEM-model made in Robot Millennium 21 was used to carry out the structural analysis of the roof truss. With this model the critical temperature of the steel was calculated for the case of fire.

In this way it was possible to show that the truss well could withstand the exhibition stand fire without any fire protection. However, the spectator stand fire resulted in too high temperatures for the unprotected truss to be able to endure the fire.

